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ROOTING OF NEEDLE FASCICLES FROM WESTERN WHITE PINE SEEDLINGS

by

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ABSTRACT

In one test, 45 out of 318 (14 percent) needle fascicles from 2-year-old seedlings of Pinus monticola Dougl. were rooted. Eight of the needle fascicles produced shoot growth. In another test, 392 out of 742 (53 percent) needle fascicles were rooted, but none of these produced shoot growth.

The production of genetically uniform, clonal lines of host plants is extremely important to fundamental investigation of plant disease resistance. Such lines supply the investigator with a powerful tool for assessing resistance reactions in the host and virulence characteristics of any biotypes of the pathogen. Knowledge of both is needed for increasing efficiency, economy, and security of resistance breeding.

In studying the western white pine:blister rust system (Pinus monticola Dougl: Cronartium ribícola J.C. Fisch.ex Rabenh.), we can produce clonal lines of the alternate host plant (Ribes spp.) with relative ease from rooted stem cuttings. However, rooting of the pine host has proven difficult. Deuber (1942) didn't obtain any rooted cuttings out of 120 taken from a 45-year-old tree, but he obtained 11 rooted cuttings from 196 taken from a 56-year-old tree. Furthermore, although production of grafted, clonal lines of western white pine is attainable (Bingham, Squillace, and Duffield 1953); Hanover 1966), the grafted plants are far from ideal for the study of blister rust resistance. First, they are relatively expensive to produce and maintain (Bingham 1966). Second, they recover quite slowly from the setback of graftage, and thus, for a year or two may remain erratic in respect to their susceptibility to the rust (Patton 1961; Bingham 1966). Third, where more than a few ramets are required, the ortet must be relatively large (thus old) and ease of inoculation decreases directly with age of white pine plants (Patton 1961). Lastly, any variation introduced by genetically heterogeneous rootstocks cannot be controlled.

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For these reasons we are interested in rooting needle fascicles of young western white pines. If fascicles can be rooted with even a moderate degree of success, clones with relatively large numbers of members may be obtained even from 2-year-old plants. For certain work, in fact, rooted fascicles that fail to produce shoots but remain alive more than a year or so may suffice.

Various workers have successfully rooted fascicles of young "hard" pines (Jeckalejs 1956; Isikawa and Kusaka 1959; Mergen and Simpson 1964; Reines and Bamping 1964; Rudolph and Nienstaedt 1964; and Kummerow 1966). Thimann and Delisle (1942) have successfully rooted needle fascicles of P. strobus, a "soft" pine, and workers at the Pacific Southwest Forest and Range Experiment Station have successfully rooted other species of "soft" pines including western white pine.[2] This paper reports moderate success attained in rooting needle fascicles of young western white pine.

During the first week of February two tests were installed. For one, needle fascicles with 2- to 3-mm.-long buds were removed from the apical leader of 2-year-old greenhouse-grown, dormant western white pine seedlings. The fascicles were treated with Rootone,[3] which contains 0.067% naphthylacetamide, 0.033% 2-methyl-1-naphthylacetic acid, 0.013% 2-methyl-1-naphthylacetamide, and 0.05% indole-3-butyric acid. These then were planted in a washed-sand culture, and placed in a greenhouse with a 16-hour photoperiod at an air temperature of about 72° F. In the second test, fascicles were taken from nursery-grown 2-year-old seedlings. Very few of these fascicles contained a fascicular bud. They were planted in a soil mixture of equal parts of sand and peat moss culture but were not given a hormone treatment. They were then placed in the same environmental conditions as in the first test. Differences between the two tests arose because the rooting of fascicles was not the objective of the second test.

During the first week of July, a tally was made of the total rooted fascicles and shoot growth in the first test and of rooted fascicles only in the second test. The total rooted was 45 out of 318 (14 percent) for the first test (table 1) and 392 out of 742 (53 percent) for the second test (table 2). Eight of the rooted fascicles in test 1 produced shoot growth (table 1, fig. 1). Shoot growth was not noted for the second test due to the absence of budded fascicles.

Tables 1 and 2 also show that rooting ability may be closely controlled by genotype. This is especially evident when tree 224 in table 1 and trees 255 and 382 in table 2 are compared with tree 272 in table 1 and trees 60 and 235 in table 2.

Having attained this moderate success, we will now test different treatments and culture methods, hoping for an increase in the rooting and shoot growth percentages. The differences found in the two tests described above indicate a real potential for increasing rooting, if not for increasing shoot growth. Disbudding plants to encourage the continued development of fascicular buds (Kummerow 1966; Ginzburg and Reinhold 1967) holds much promise for increasing the proportion of rooted fascicles with shoot growth.

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[2]Personal communication from Dr. Stanley L. Krugman.

[3]Use of trade names herein is for identification only and does not necessarily imply endorsement by the U.S.D.A. Forest Service.

Table 1.--Number of fascicles rooted and shoots produced following planting in washed-sand culture of hormone-treated needle fascicles from greenhouse-grown western white pine seedlings

Female tree no.	Male tree no. 17 Fasc. rooted	17 Shoots prod.	17 Fasc. planted	19 Fasc. rooted	19 Shoots prod.	19 Fasc. planted	22 Fasc. rooted	22 Shoots prod.	22 Fasc. planted	58 Fasc. rooted	58 Shoots prod.	58 Fasc. planted	Total Fasc. rooted[1]	Total Shoots prod.[2]	Total Fasc. planted
277	2	0	12	1	0	12	1	0	12	1	0	12	5(10)	0	48
208	1	0	12	1	1	12	2	1	12	2	0	12	6(13)	2(4)	48
272	1	0	6	5	1	9	3	0	8	1	0	7	10(33)	1(3)	30
197	0	0	12	3	0	12	4	2	12	0	0	12	7(15)	2(4)	48
15	2	0	12	0	0	12	3	1	12	3	0	12	8(17)	1(2)	48
20	1	1	12	1	1	12	2	0	12	5	0	12	9(19)	2(4)	48
224	0	0	12	0	0	12	0	0	12	0	0	12	0	0	48
Total	7(9)[1]	1(1)[2]	78	11(14)[1]	3(4)[2]	81	15(19)[1]	4(5)[2]	80	12(15)[1]	0	79	45(14)	8(3)	318

[1]Numbers in parentheses represent percentile values of fascicles rooted to fascicles planted.
[2]Numbers in parentheses represent percentile values of shoots produced to fascicles planted.

Table 2.--Number of fascicles rooted following planting in a soil mixture of sand and peat moss culture of needle fascicles from nursery-grown western white pine seedlings

Female tree no.	Male tree no. 17 Fascicles Rooted	17 Fascicles Planted	19 Fascicles Rooted	19 Fascicles Planted	22 Fascicles Rooted	22 Fascicles Planted	58 Fascicles Rooted	58 Fascicles Planted	Totals Fascicles Rooted	Totals Fascicles Planted
33	--	--	1	1	4	10	0	1	5(42)[1]	12
60	7	12	5	5	5	10	6	11	23(61)	38
67	--	--	8	9	6	9	2	5	16(70)	23
95	1	1	--	--	1	2	5	12	7(47)	15
99	2	10	5	12	4	6	3	5	14(42)	33
112	--	--	3	3	3	7	2	6	8(50)	16
115	0	9	6	11	3	3	2	5	11(39)	28
121	2	7	3	8	7	12	7	11	19(50)	38
138	1	4	2	3	7	9	4	6	14(64)	22
177	3	12	9	11	1	6	3	6	16(46)	35
179	5	8	0	4	7	10	5	12	17(50)	34
184	10	10	5	7	5	9	0	7	20(61)	33
211	1	9	4	7	8	9	6	7	19(59)	32
227	4	8	3	5	1	2	0	3	8(44)	18
230	3	10	3	8	8	10	4	8	18(50)	36
232	4	4	10	12	1	2	5	7	20(80)	25
235	2	4	11	11	1	1	9	12	23(82)	28
255	4	9	3	12	6	7	0	3	13(42)	31
261	4	7	7	11	1	11	2	4	14(42)	33
262	2	4	5	11	4	11	5	9	16(46)	35
265	9	11	5	8	1	1	3	3	18(78)	23
269	1	1	3	9	3	3	5	6	12(63)	19
274	--	--	2	9	--	--	1	5	3(21)	14
382	0	1	1	3	1	11	1	7	3(14)	22
383	2	3	6	10	4	5	3	11	15(52)	29
384	--	--	2	2	5	9	5	5	12(75)	16
252	5	6	--	--	1	4	5	12	11(50)	22
263	7	9	7	11	2	4	--	--	16(67)	24
57	1	8	--	--	--	--	--	--	1(13)	8
Total	80(45)	167	119(53)	203	100(55)	183	93(49)	189	392(53)	742

[1] Numerals in parentheses are percentile values of fascicles rooted to fascicles planted.

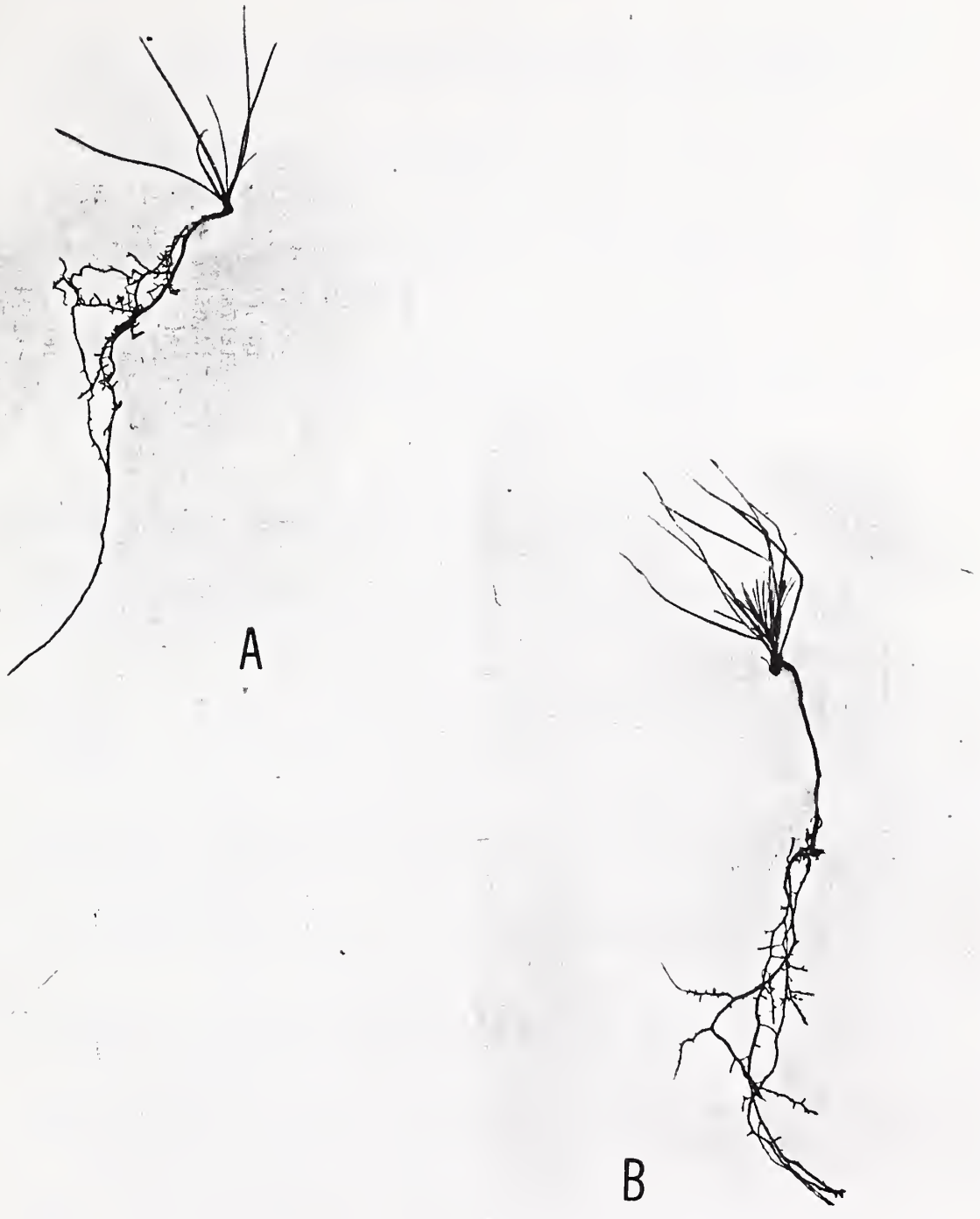

Figure 1.--A rooted needle fascicle of western white pine: *A*, without shoot growth; *B*, with shoot growth.

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